Powerful Arguments

Standards of Validity in Late Imperial China

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Contents

CHAPTER 6

Keeping Your Ear to the Cosmos: Coherence as the Standard of Good Music in the Northern Song

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In the Song dynasty (960–1279), several kinds of music thrived: some to entertain at banquets, some to boost soldierly fortitude, and a particularly prestigious kind to instill imperial ideology. This essay focuses on the last kind, the so-called "ceremonial music" (*yayue* 雅樂).[1] Extensively used in various state rituals, ceremonial music conveyed glory and solemnity in the presence of the imperial monarch.[2] This music genre—along with its ideological heft—was not a Song invention. Ever since the classical age, "music" (*yue* 樂) was joined with "ritual" (*li* 禮) to signify the ultimate means to achieve order. The use of ceremonial music at state rituals originated in the Western Zhou 西周 dynasty (1045–771 BCE). In the ritual context, ceremonial music was supposed to present a "harmonious" (*he* 和) relationship between the emperor and sacred beings such as royal forebears, deities, and Heaven.[3] If the court sensed that the music had fallen out of harmony and dynastic legitimacy was at risk, a reform would then arise.

This article examines the standards by which Song musicologists validated their claims to have recovered good ceremonial music. They developed a rich discourse that boiled down to three key propositions:

i. Good music descended from antiquity.
ii. Good music arose from the proper measurement of stacked millet grains.
iii. Good music bore a harmonious relationship to the cosmos.

1 For a comprehensive introduction to the three major types of court music in the Song, see Yang Yinliu 楊蔭瀏, *Zhongguo gudai yinyue shigao* 中國古代音樂史稿 [Draft history of music in pre-modern China] (Beijing: Renmin yinyue chubanshe, 2004), 380–416.

2 For the contexts and utility of ceremonial music, see Li Youping 李幼平, *Dacheng zhong yu Songdai huangzhong biaozhun yingao yanjiu* 大晟鐘與宋代黃鐘標準音高研究 [A study of the Dasheng Bells and the Yellow Bell pitch standard in the Song] (Shanghai: Shanghai yinyue xueyuan chubanshe, 2004), 15–18.

3 Wang Yinglin 王應麟 comp., *Yuhai* 玉海 [Jade sea] (first printed 1269, repr. of the 1883 ed., Nanjing: Jiangsu guji chubanshe, 1987), 7.15a. Erica Fox Brindley provides a detailed analysis of the cosmic significance of ritual music in early China. Many of the fundamental ideas—such as the belief in harmony—still prevailed in the middle period. See Brindley, *Music, Cosmology, and the Politics of Harmony in Early China* (Albany: State University of New York Press, 2013), 25–85.

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Though seemingly disparate, the three propositions cohered with one another and generated a unified musicological scheme of argumentation. The making of proper ceremonial music thus featured an antiquarian motif, a quantitative method, and a cosmological framework. In this study, I explain how these components coordinated with one another and demonstrate the systematic impact they exerted on the practice of music production.

Notably, this musicological scheme left out one factor critical to the conventional understanding of music making: auditory judgment. While Song scholars indeed admitted that good music should please the ear, they did not make it an official epistemic guide in music theory. I argue that the primary standard for arguments that validated good ceremonial music resided in cosmic coherence rather than auditory experience. Indeed, when Song scholars contemplated the nature of music, they set their attention on an expansive universe rather than on the intimate relationship between the human ear and sounds.

1 Music in Political Theater

Since the founding of the Song, ceremonial music had remained a central political issue and constantly demanded monarchs' personal attention. The Song emperors inherited this fixation from the previous period of political division, the Five Dynasties (907–960). As the rulers of regional regimes engaged in heated contestations for territory and power, they found in ceremonial music the ultimate symbol of political legitimacy to rule the Middle Kingdom. Many of them immediately saw to formulating a program of ritual and music as soon as they secured military success.[4] Because, in their own words: "The ancient kings made rituals after patterns were settled, and produced music after (military) accomplishments were achieved" 古之王者，理定制禮，功成作樂.[5] During the tumultuous Five Dynasties, regional warriors often rose to rulership through might, and they coveted nonviolent ways to legitimize newly gained power. Music became a desirable instrument to serve this purpose. In a significant way, the relentless rivalries among the Five Dynasties warlords amplified the interest in ceremonial music. The drastic development eclipsed the

4 For a brief account of efforts to reform ceremonial music in the Five Dynasties, see Wu Peng 吳朋, "Sui Tang Wudai yayue baikao" 隋唐五代雅樂稗考 [Trivial examinations of ceremonial music in the Sui, Tang, and Five Dynasties], *Zhongguo yinyue xue* 中國音樂學 2004, no. 1: 46–47.

5 Xue Juzheng 薛居正 and Chen Shangjun 陳尚君, eds., *Jiu Wudai shi xin ji huizheng* 舊五代史新輯會證 [Newly collated *Old History of the Five Dynasties*] (Shanghai: Fudan daxue chubanshe, 2005), 144.4439.

bygone Tang dynasty, when emperors enjoyed the security of a long-standing unified empire and indulged in exotic banquet music imported from foreign lands to the west.[6]

The competition for political legitimacy resulted in repeated efforts to revise ceremonial music. From Five Dynasties warlords through Song emperors, generations of rulers viewed the renewal of ceremonial music as a symbolic affirmation of their authority. Emperors and their scholarly advisors believed that the ability to mobilize a music reform corroborated the state's capacity to outstrip predecessors and launch a superior new era. This was the fundamental rationale for the occurrence of a total of six music reforms in the Northern Song.[7]

Ceremonial music was highly political. It was an independent constituent of Northern Song politics rather than its auditory paraphernalia. Music production was not a neutral technology run by specialists; instead, it was meticulously managed by the dominant socio-political elite, the literati. The so-called literati musicologists were recipients of an education based on the Confucian Classics. Any diligent student steeped in this tradition would potentially have a proper exposure to ceremonial music, a prominent topic in the classical curriculum. Judging from the rich body of writings on music, we can safely assume that most Song literati had enough rhetorical ability to engage this subject in regard to the ideological significance of music. Some literati made further advancements—thanks to family tradition or strong personal interest—in exploring the technical aspects of the art. Most of the court musicologists responsible for the reforms under discussion emerged from this sub-group.

6 For a detailed account of the musical landscape in the Tang, especially the prosperity of banquet music and decline of ceremonial music, see Yang Yinliu, *Zhongguo gudai yinyue shigao*, 213–226, 246–251.

7 For representative accounts on all six reforms, see Li Youping, "Songdai yinyue shijian zhong de huangzhong biaozhun yingao" 宋代音樂實踐中的黃鐘標準音高 [The pitch standard Yellow Bell in Song musical praxis], *Yinyue yanjiu* 音樂研究 2001, no. 2: 47–54; Christian Meyer, *Ritendiskussionen am Hof der nördlichen Song-Dynastie 1034-1093: Zwischen Ritengelehrsamkeit, Machtkampf und intellektuellen Bewegungen* (Nettetal: Steyler, 2008), 163–253; and Hu Jingyin 胡勁茵, "Cong Da'an dao Dasheng" 從大安到大晟 [From Da'an to Dasheng], (PhD diss., Zhongshan daxue, 2010). For concise summaries of the common goal of these reforms, see Rulan Chao Pian, *Sonq Dynasty Musical Sources and Their Interpretation* (1967; repr., Hong Kong: Chinese University Press, 2003), 1; and Joseph S. C. Lam, "Huizong's Dashengyue, a Musical Performance of Emperorship and Officialdom," in *Emperor Huizong and Late Northern Song China: The Politics of Culture and the Culture of Politics*, ed. Patricia Buckley Ebrey and Maggie Bickford (Cambridge, MA: Harvard University Asia Center, 2006), 418–427.

2 Antiquarianism

The discussion of ceremonial music often occurred between the emperor and literati at imperial auditions, and the literati packaged the colloquies on music in a scholarly language. Most notably, they discussed the subject with a recurrent antiquarian motif, the first sign indicating that music was not merely a technical art.[8]

Good, harmonious ceremonial music was supposed to have existed in the times of ancient sage kings, so that return to antiquity remained a theme in all six Song music reforms. In this section I discuss the second and the sixth as two central examples. When Emperor Renzong 仁宗 (r. 1023–1063) consulted an editor at the Imperial Libraries, Li Zhao 李照 (fl. 1020s), for opinions on ceremonial music, Li answered: "The pitch is too high. Compared to ancient music, it is five pitches higher" 其於聲調則乃太高，比之古樂約高五律.[9] Using ancient music as a direct referent, Li Zhao made a straightforward point: proper modern music should return to the ancient system by transposing down five notes. It should be a simple restoration. Li's proposal then led to a music reform—the second among six in the Song.

The reactions to Li's reform were also framed in antiquarian language, nevertheless. Han Qi 韓琦 (1008–1075), one of the most influential ministers at this time, criticized Li for deviating from the ancient system:

> The music made by Li Zhao does not follow the ancient system. [He] acted on his own whim and contrived a different set of pitch standards. The court has followed him and put his system in implementation, and yet it has been a while that we all have seen this as being erroneous.[10]
>
> 李照所造樂不依古法，率意妄行，別為律度，朝廷因而施用，議者久以為非。

Minister Wang Zeng 王曾 (978–1038) issued a similar critique, enumerating vices improper music such as Li's might provoke:

8 For a general introduction to Song antiquarianism, see Peter K. Bol, *Neo-Confucianism in History* (Cambridge, MA: Harvard University Asia Center, 2008), 61–65. For an analysis of the study of old artifacts (*jinshi xue* 金石學) as part of the antiquarian movement, see Jeffrey Moser's chapter in this volume.

9 Xu Song 徐松, ed., *Song huiyao jigao* 宋會要輯稿 [Collected drafts of essential documents of the Song] (between 1809 and 1820; repr. Taipei: Xinwenfeng chuban gongsi, 1976), Yue 樂 1.1a.

10 Xu Song, *Song huiyao*, Yue 2.35b.

> The reason why ancient music was employed to worship ancestors, to summon deities, to simulate *yin* and *yang*, and to attract good fortune, is that its elegance and rightness resonated with Heaven and Earth in a harmonious way. With the music of today, however, that is no longer the case. It disturbs emotions and nature, deludes vision and hearing, opens up new sources of desires, generates chaos and peril, and does no good to ultimate order.[11]
>
> 古之樂所以鄉宗廟、格神祇、法陰陽，來福祉者，蓋雅正之音與天地同和也。今之樂則不然，蕩情性，惑視聽，開嗜欲之源，萌禍亂之本，無益於至治也。

Decades later, the celebration of the antiquarian scheme reached its climax after the conclusion of the sixth reform, as the reigning monarch—Emperor Huizong 徽宗 (r. 1100–1125)—believed that this reform had finally brought the ancient music back to life. He held a public ceremony to celebrate this achievement and named the new music *Dasheng* 大晟 ("Grand Prosperity"), which placed it on a par with exemplary ancient systems such as *Dazhang* 大章 ("Grand Luminosity") and *Dashao* 大韶 ("Grand Splendor").[12] In the account of this occasion, court chroniclers recorded an unusually auspicious omen: a few cranes glided into the imperial court, circling and cheering in resonance with the emperor's merry countenance.[13] The successful revival of ancient music thus turned the entire imperial court into a consummate state of celebration.

The apparent simplicity of the antiquarian model invites questions, however: first and foremost, where did one find the putative old music? Since it was the business of literati, they would likely resort to old texts. If one simply had to retrieve evidence from historical records, why did it take the efforts of multiple generations, six reforms, and cyclical mutual accusations to complete the task? Li Zhao's case poses this question most acutely: how could someone who proposed a clear antiquarian solution stand accused of having gone woefully awry from the ancient way?

The next questions concern the relation between discourse and praxis. What impact did an antiquarian argument have on the actual manufacture of music? In what forms did the Song literati transpose the antiquarian motif into

11 Xu Song, *Song huiyao*, Yue 4.16b.

12 Tuotuo 脫脫 et al., comps., *Songshi* 宋史 [History of the Song] (1345; repr. Beijing: Zhonghua shuju, 1977), 129.3001–3002.

13 Tuotuo, *Songshi*, 129.3001.

the technical aspect of music making? And, more broadly, how did cultural imagination and technical engineering mutually fashion one another?

To fully answer these questions, my exploration of the antiquarian theme naturally extends into the second and eventually the third propositions, which in combination reveal the broad discursive field Song literati carved out for the art of music making.

3 The Quantitative Method

The restoration of ancient music involved multiple procedures in regard to harmonics, melodies, instruments, and lyrics. The central task resided in establishing the correct pitch. Thus, the second proposition of Song musicology concerned mathematical harmonics and presented a quantitative approach.

Before delving into the Song reforms, let me first introduce some basics of traditional Chinese harmonics. The system came into being during the Han dynasty (206 BCE–220 CE). One of its fundamental musicological assumptions was to evenly divide the span of an octave into twelve semi-tones. The six odd-numbered semi-tones—*lǜ* 律—and the even-numbered semi-tones—*lǚ* 呂—together constituted the system of twelve "pitch standards" (*lǜlǚ*). The twelve pitch standards were designated as *huangzhong* 黃鐘 (translated hereafter as "Yellow Bell"), *dalü* 大吕, *taicu* 太簇, *jiazhong* 夾鐘, *guxi* 姑洗, *zhonglü* 仲吕, *ruibin* 蕤宾, *linzhong* 林鍾, *yize* 夷則, *nanlü* 南吕, *wuyi* 无射 and *yingzhong* 應鐘.[14]

This system serves as the foundation from which musicians constructed scales. The most prevalently used scale in traditional Chinese music was a pentatonic mode consisting of five notes: *gong* 宫, *shang* 商, *jue* 角, *zhi* 徵, and *yu* 羽. In modern notation, these notes respectively correspond to *do*, *re*, *mi*, *sol*, and *la*. Each of the twelve pitches could serve as *gong*, i.e., the tonic, to launch a pentatonic scale. The twelve pitches matched with the five notes in rotation

14 For a brief introduction to the system, see Chen Yingshi 陳應時, "Zhongguo gudai wenxian jizai zhong de 'lü xue'" 中國古代文獻記載中的律學 [Harmonics in pre-modern Chinese sources], *Zhongguo yinyue* 1987, no. 2: 11; and Yang Yinliu, *Zhongguo gudai yinyue shigao*, 42–43. The etymologies of most pitch names remain elusive, and literal translations are barely informative. In this article, I translate the primary pitch ("Yellow Bell") only (for readers' convenience) and refer to the others in original Chinese. For a discussion of the meanings and possible translations of the pitch designations, see Lothar von Falkenhausen, "On the Early Development of Chinese Musical Theory: The Rise of Pitch-Standards," *Journal of the American Oriental Society* 112, no. 3 (1992): 433–439.

and generated sixty pitches in total.[15] Each new pitch was a combination of one of the twelve pitch standards and its relative position in the pentatonic scale. For instance, *linzhong gong* 林鐘宮 denoted a scale in which the pitch *linzhong* was the keynote.

To make harmonious music, a musician should first and foremost establish the absolute pitch of the first note, "Yellow Bell." This pitch was foundational, as it generated all subsequent pitches and all pentatonic scales. The task was deceptively straightforward: to determine the Yellow Bell was to identify a sound with a suitable frequency to serve as the fundamental note. What counted as suitable, however, became a thorny issue for post-antiquity music makers. According to legend, musicians in golden antiquity determined the pitch simply by ear. Cai Yong 蔡邕 (132–192), a renowned scholar in the Eastern Han (25–220), believed that in the Western Zhou (1046–771 BCE), the Chief Director of Music (*Da siyue* 大司樂) was usually a blind man with extraordinary auditory acuity, who "used his ears to designate the pitch" (*yi er qi qi sheng* 以耳齊其聲).[16] Although all evidence in support of this claim came from periods later than the Western Zhou, the idea seemed compelling enough and remained an important proposition in the discourse on ancient music.

In the post–Western Zhou era, musicians no longer relied on auditory judgment to determine pitches. In Cai Yong's observation, a quantitative approach replaced the human ear during the Han, and musicologists sought harmony in mathematical terms.[17] One connection remained in place: Han scholars imagined that the quantification of the pitch system started in antiquity, and the perfect numbers they used as the foundation of their calculations came from the blind predecessors. A Warring States account in the *Discourses of the States* (*Guoyu* 國語) recorded: "The blind genius in antiquity identified the proper sound, measured it in definite terms, transcribed it into a pitch standard, and then [transferred it to] a regulator" 古之神瞽，考中聲而量之以制，度律均鐘.[18] "Measuring in definite terms" is an unambiguous reference to quantification. In modern scientific terms, to quantify the pitch of a sound is to measure the frequency of its vibrations; as a sound travels through a medium, the particles of the medium vibrate to its movement. Thousands of years before the invention of the oscilloscope, the blind genius relied on a tubal instru-

15 Tuotuo, *Songshi*, 34.1911.

16 Cai Yong, *Yue ling zhangju* 月令章句 [Commentaries on the *Monthly Ordinance*], in *Han Wei yishu chao* 漢魏遺書鈔 [Excerpts from lost books from the Han and Wei], comp. Wang Mo 王謨, 1798, 18a.

17 Cai Yong, *Yue ling zhangju*, 18a.

18 Xu Yuangao 徐元誥, *Guoyu jijie* 國語集解 [Collected annotations on the *Discourses of the States*] (1930; repr. Beijing: Zhonghua shuju, 2002), 3.113.

ment to render a sound into a numerical value. A pipe of a certain length, when blown, produced a corresponding pitch. Thus, the length of the pipe became the mathematical value of the sound.

Han scholars skipped the step of listening and delved into calculation right away, a change Cai Yong deemed *faute de mieux*. He lamented that musicologists of his age were "no longer capable of" (*buneng* 不能) repeating the actions of the blind genius.[19] Arithmetic calculation was "not as sound as determining by ear" (*buru er jueming ye* 不如耳決明也).[20] Nonetheless, Cai still acknowledged the advantages of quantification, because it made "textualization and oral transmission" (*wenzai kouchuan* 文載口傳) possible.[21]

Despite his disappointment in the current practice, Cai Yong documented how musicologists worked in his day. The scholars "relied on numbers to rectify the measures" (*jia shu yi zheng qi du* 假數以正其度); as soon as "the standard measures are rectified, the pitches become correct as well" (*dushu zheng, ze yin yi zheng yi* 度數正，則音亦正矣).[22] This terse statement lumps together multiple procedures. First, musicologists were supposed to have reliable data on the lengths of pitch pipes. An assortment of historical data on the lengths of the tubes had once existed, but by Cai Yong's time this variety had been pared down to one: the length of the Yellow Bell pipe was a constant nine *cun* 寸.[23] A nine-*cun* Yellow Bell pitch pipe was presumably the standard stipulated by ancient sages, and it strictly permitted no willful changes.

The next step was to determine exactly how long nine *cun* was, which Cai Yong described as "rectifying the standard measures." Though a long-established unit of measure, the actual length of a *cun* had historically been in flux, and its absolute value in ancient times was shrouded in obscurity. For people in subsequent ages, the discrepancy between the current and ancient values of *cun* was a root cause for all ills of contemporaneous music. If the pitch standards went awry, a musicologist would troubleshoot by seeking the ancient, original dimension of the basic measure. The means to retrieve the original length of *cun* was quantitative, in many cases taking the form of measuring millet grains. The practice well continued into the Song, hence the emergence

19 Cai Yong, *Yue ling zhangju*, 18a.

20 Cai Yong, *Yue ling zhangju*, 18b.

21 Cai Yong, *Yue ling zhangju*, 18a.

22 Cai Yong, *Yue ling zhangju*, 18a.

23 In the Han dynasty one *cun* was approximately 0.917–0.920 inches (2.32–2.33 cm), and its dimensions increased to 1.22–1.29 inches (3.09–3.28 cm) in the Song. For the conversion rates, see Ju Zhai 矩齋, "Gu chi kao" 古尺考 [A study of old measures], *Wenwu cankao ziliao* 文物參考資料 79, no. 3 (1957): 28.

of the second proposition, that "good music arose from the proper measurement of stacked millet grains."

In the following, I focus on the first three Song reforms to explain the quantitative scheme. The first reform occurred as soon as Emperor Taizu 太祖 (r. 960–976), the founding monarch, managed to turn from warfare to domestic rule. He discerned that the current ceremonial music was so high in pitch that it "resembled grief" (*jin yu ai si* 近於哀思) and thus "failed to accord with harmony" (*bu he zhong he* 不合中和).[24] The emperor recruited He Xian 和峴 (940–995) to conceive a reform. He Xian was a literatus, a descendent of a prominent official lineage, and the then Erudite at the Court of Imperial Sacrifices (*Taichang boshi* 太常博士).[25] In response to the emperor, he presented a prospectus:

> The sounds of the twelve months used to be shrouded in silence. The ancient sages instituted pitch standards and brought them out in performance. They established *chi*[26] and *cun* to designate the pitch standards. Added or subtracted in thirds, [the pitch standards] generate one another up and down and then match with real sounds.[27] [The pitch standards and the sounds respectively] constitute the so-called forms and objects. However, it is not possible to textualize the lengths of *chi* and *cun*, so [the sages] heaped grains of millet to establish a permanent standard. People in subsequent ages had tried [to restore the ancient measures], but [their results] were often amiss. The bronze pole [as part of a gnomon] in the Western Capital (Luoyang) can be used to deduce the ancient standards. There is a bronze pole on the gnomon in our current imperial observatory. Under the pole there is a stone measure. [I] have compared it to the measure [stipulated] by [Wang] Pu, and found the latter to be four *fen* shorter.[28] Then I realized the high pitch of current music has come from this. Since a gnomon measures Heaven and Earth, it can certainly provide a model for the pitch pipes.[29]

24 Tuotuo, *Songshi*, 79.2941.

25 Tuotuo, *Songshi*, 439.13012–13013.

26 One *chi* equaled ten *cun*.

27 This statement referred to the "Method of Adding and Subtracting in Thirds" (*sanfen sunyi fa* 三分損益法), the method to determine the division of the twelve pitch standards within one octave. The method employed 1:3 as the basic constant, multiplying the lengths of pitch-pipes by either 4/3 (1+1/3) or 2/3 (1–1/3). For a detailed introduction, see Howard L. Goodman, *Xun Xu and the Politics of Precision in Third-Century AD China* (Leiden: Brill, 2010), 220–221.

28 One *fen* equals 1/10 of one *cun*.

29 Xu Song, *Song huiyao*, Yue 1.1a–b.

> 十二月聲，含在寂默，古聖設法，演而出之。立尺寸作為律吕，三分損益，上下相生，取合真音，謂之形器。但以尺寸長短非書可傳，故累秬黍，永为準的。後代試之，或不符會。西京銅望臬可校古法。今司天臺影表上有铜臬，下有石尺是也。今以朴尺比量，短於影表上尺四分，方知今樂聲之高，皆由於此。况影表測於天地，則律管可以準繩。

In this memorial, He Xian demonstrated a number of insights which persuaded the emperor to entrust the music reform to him. First, he put forth a distinctively antiquarian stance by reiterating that true, harmonious music emerged from sagely hands. Second, he admitted that due to the difficulty of preserving the exact dimensions of the ancient measures, the current system was no longer accurate; specifically, its pitches had gone awry. He further diagnosed the issue in technical terms, that the higher pitch was the result of a foreshortened metric standard. He Xian arrived at this conclusion by comparing the measure currently in use to a stone ruler attached to a bronze gnomon, and the latter was 4 *fen* (4/10 *cun*) longer. The bronze gnomon was known as a Western Jin 西晉 (265–316) artifact, which represented a third-century effort to restore Western Zhou measures,[30] while the current system was a Five Dynasties product inherited from Wang Pu 王朴 (fl. mid-tenth century). The older provenance of the stone measure reasonably justified He Xian's judgment.

To follow, He Xian established a new set of measures and built a new Yellow Bell tube accordingly. He also devised two separate procedures to verify the new data he presented. First, He Xian commissioned technicians to test the new pitch on musical instruments and confirmed that it was indeed one semitone lower than the old pitch. And next, he turned to the millet method described in the second proposition. He Xian procured a special type of millet grown in Yangtou 羊頭 Mountain in Shangdang 上黨 (modern-day Shanxi) and verified the length of the new pipe with these grains.[31]

To fully unpack He's second move we need to trace back to the origin of the millet method. Musicologists since the Han had employed millet grain as a metric unit of length and mass. They believed that one grain of a type of black millet was the equivalent of the smallest measurement unit used in antiquity, one *fen*.[32] Ten *fen* made up one *cun*. Thus the length of the Yellow Bell tube should be:

30 For the provenance of the stone measure, see Hu Jingyin, "Cong Da'an dao Dasheng," 26.

31 Tuotuo, *Songshi*, 68.1494.

32 Ban Gu 班固, *Hanshu* 漢書 [History of the Han] (96 CE; repr. Beijing: Zhonghua shuju, 1962), 21.966. For a brief introduction to the method of millet measurement, see Joseph

9 *cun* = 90 *fen* = 90 grains of millet

In He Xian's case, the particular type of millet he chose was cultivated in Yangtou Mountain, allegedly the birthplace of the ancient sage Emperor Yan (Yan Di 炎帝).[33] Emperor Yan was also known as the "Divine Farmer" (*Shennong* 神農), the legendary author of the first classic of *materia medica*. Grains grown in his birthplace were presumably extraordinary and thus qualified as a standard measure. To He Xian's delight, the new Yellow Bell tube was indeed of the same length with ninety grains of the Yangtou millet. He further built a new set of twelve pitch pipes and proclaimed that ceremonial music was again "harmonious and fluent" (*hechang* 和暢).[34]

In 1022, more than half a century after the first reform, the second reform began. Having heard the melodies performed at the ancestral rituals one day, Renzong, the fourth Song emperor, asked Li Zhao for his opinion of the music. Li responded candidly that he was bothered by the excessively high pitch. Upon the request of the emperor, Li Zhao explained:

> The pitch standards made by Wang Pu were five semitones higher than ancient music, and two semitones higher than [contemporaneous] conservatory music. When striking the Yellow Bell note, one gets *zhonglü* instead; and when hitting *jiazhong*, one gets *yize* instead. Therefore, the winter [improperly] provokes the ordinance of the summer, and the spring [erroneously] calls upon the seasonal influence of autumn. Ceremonial music was ravaged during the chaotic Five Dynasties. [Wang] Pu's creation of pitch standards was not congruent with ancient practice. [Wang's system] would not entail any fortune if we were to continue using it in our dynasty. [Wang] failed to identify differences in terms of size, weight, volume, and length when making bronze bell sets and single large bells. The bronze [he used] was not refined, so the music lost its beauty. [The sounds produced by] the larger ones are intimidating, whereas [those produced by] the smaller ones are spiritless. None of them is an instrument of appropriate measure… [I] beseech [your majesty] to let your subordinate build a new set of bronze bells according to the method of the blind genius, so that [we] can bring the measurement system back to harmony.[35]

Needham, Wang Ling, and K. G. Robinson, *Science and Civilisation in China. Vol. 4, Part 1: Physics* (Cambridge: Cambridge University Press, 1962), 199–202.

33 For an analysis of this history, see Hu Jingyin, "Cong Da'an dao Dasheng," 27.

34 Wang Yinglin, *Yuhai*, 7.15a.

35 Chen Bangzhan 陳邦瞻, *Songshi jishi benmo* 宋史紀事本末 [Individuated accounts of events in the *History of the Song*] (1605; repr. Beijing: Zhonghua shuju, 1977), 28.212.

> 王朴律準，視古樂高五律，視教坊樂高二律，擊黃鐘則為仲呂，擊夾鐘則為夷則，是冬興夏令，春召秋氣。茲五代之亂，雅樂廢壞，朴創意造律準，不合古法，用之本朝，卒無福應。又編鐘、鎛鐘，無大小輕重厚薄長短之差，銅錫不精，聲韻失美。大者陵，小者抑，非中度之器。..... 願聽臣依神瞽律法，試鑄編鐘一虡，可使度量權衡協和。

Just like He Xian, Li Zhao invoked the antiquarian motif and again laid blame on Wang Pu.[36] Li's technical diagnosis was straightforward, that the current system was five semitones higher than ancient music. He then quickly turned to the solution: to build a new set of bronze bells according to the standards stipulated by "the blind genius." Li disclosed no further detail of this work; presumably, the new bells played a tone five pitches lower.

Li's reform could have ended with the procedures described in the prospectus, and yet perhaps out of prudence, he enacted a second program to make new pitch pipes. Li used the millet method first, choosing millet produced in a place known as Jing county 景縣 (modern-day Hebei), but the resultant pitch was still too high. He then resorted to an existing measure, the so-called "cloth measure used in the Ministry of the Imperial Treasury" (*Taifu bubo chi* 太府布帛尺), the metric standard the Song government used to measure bolts of cloth submitted as tax payment. Li adopted the numerical value of this measure to determine *cun* and successfully lowered the new pitch by four semitones. He turned back to the millet method to verify the result, and this time he ordered significantly larger grains from Yangtou Mountain to afford a good match.[37] In addition, Li added fancy formal ornaments to his new system: he replaced the conventional decimal system with a base-9 system and created two new units of length.

The records of Li's reform bore several ambiguities. To begin with, the first project described in the memorial did not seem to pertain to his subsequent actions. According to the memorial, he had already identified the pitch standard of ancient music, which was five semitones lower. But in the subsequent project, he came up with a new version that was four semitones lower. The discrepancy indicates that the second procedure was perhaps independent from the first, but it is unclear why Li devised two separate programs. It could

36 Before Li Zhao came on the scene, Emperor Renzong had already completed a project of instrument renovation, in which bells and chimes were tuned in accordance with Wang Pu's pitch standards. It is not stated in any available source why this project circumvented the more recent He Xian system and returned to the Five Dynasties system. This decision anteceded Li Zhao's criticism of Wang Pu (instead of He Xian). For this renovation project, see Xu Song, *Song huiyao*, Yue 2.1b.

37 Tuotuo, *Songshi*, 126.2949.

be that the first was merely a pilot project to secure the emperor's confidence, while the second constituted the genuine core of the reform. In addition, it is not difficult to spot a hint of duplicity in the second program. Li tried two different types of millet and used the standard cloth measure as a third source. Without consistent grounding for his choices, he acted as if he was fiddling with data to fit a presupposition.

Despite these cracks, Li Zhao declared his reform a success nevertheless. In Ouyang Xiu's 歐陽修 (1007–1072) documentation, Li was tremendously proud of his achievement, as he boldly preached:

> A higher pitch causes anxiety, while a lower pitch conveys relaxation. My music will resonate with the human heart and make it relaxed and harmonious. [Hearing my music], both humans and other living creatures will grow stately and grand.[38]
>
> 聲高則急促，下則舒緩，吾樂之作，久而可使人心感之皆舒和，而人物之生亦当豐大。

Li's colleague Wang Zhu 王洙 (997–1057), short in stature, asked him jocosely: "Once your music is completed, can it help me grow [taller]" 君樂之成，能使我長乎?[39]

Ironically, Li Zhao's system was never truly in use. The emperor sanctioned the new music and commissioned the production of new bells. According to Ouyang Xiu's account, the vocalists found the key impossibly low for singing. They secretly bribed the court artisans, who reduced the use of metal and made thinner walls for the bells.[40] This change resulted in a pitch higher than Li's stipulation, but he was never aware of the subterfuge. Li's system was presumably "in use" for three years, until 1025, when a number of prominent literati, including Han Qi, Song Shou 宋綬 (991–1040), and Yan Shu 晏殊 (991–1055), submitted a joint memorial of impeachment. As cited above, they found Li "acting on his own whim and contriving a different set of pitch standards," hence "not following the ancient system."[41] Eventually, the second reform concluded with the emperor's abolishment of Li's system and a return to He Xian's music.

38 Ouyang Xiu 歐陽修, *Guitian lu* 歸田錄 [A record of returning to the fields] (1067; repr. Beijing: Zhonghua shuju, 1981), 1.15.

39 Ouyang Xiu, *Guitian lu*, 1.15.

40 Ouyang Xiu, *Guitian lu*, 1.14–15.

41 Xu Song, *Song huiyao*, Yue 2.1b.

The third reform was set in motion immediately after the scrapping of Li Zhao's work. This time the emperor summoned two literati, Hu Yuan 胡瑗 (993–1059) and Ruan Yi 阮逸 (*jinshi* 1027), to work as a team. Both were renowned classical scholars, and Hu Yuan was specially revered as one of the "Three Masters of the Early Song" (*Song chu san xiansheng* 宋初三先生) in later ages. The process of this reform was slightly more complex than the former two and culminated in the compilation of a book-length account entitled *Illustrated Records of the New Music of the Huangyou Reign* (*Huangyou xinyue tuji* 皇祐新樂圖記, hereafter *Huangyou New Music*).

At the opening of this treatise, Hu and Ruan announced the antiquarian theme again. In the preface, they identified seven faults in the current bells and three problems in the chimes, which were "inconsistent with the ancient system" (*bu he gu zhi* 不合古制),[42] hence the pressing need for rectifications. In the opening chapter entitled "Four Illustrated Records of the Pitch Standards and Measures" (*Lüdu liangheng situ* 律度量衡四圖), they immediately called for the most urgent task of all: determining the proper pitch standard.

Hu and Ruan once again turned to millet grains to calculate the right pitch standard.[43] After surveying the history of the millet method in regard to technical particulars, such as the numbers of grains, the dimensions of a single grain, and the appropriate placement of grains (along the long or short side), they decided to employ the same stacking method with creative adjustments. They noticed that Li Zhao had lined up grains on their long sides, which might have contributed to the excess length of the pipe (and subsequent high pitch). Hu Yuan flipped each grain by 90 degrees so that the shorter sides stacked up to a shorter nine-*cun* tube.

To verify the result, Hu and Ruan carried out a new procedure which involved grains in a different fashion: this time the focus was on the grains' "volume" (*liang* 量) rather than length. According to another Han-originated practice, a nine-*cun* Yellow Bell tube should have the capacity to contain 1,200 grains of millet.[44] To their delight, the newly made tube held precisely 1,200 grains, and in contrast, Li Zhao's longer tube could contain 1,730. The new pitch passed the test.

42 Hu Yuan and Ruan Yi, *Huangyou xin yue tu ji* 皇祐新樂圖記 [Illustrated records of the new music of the Huangyou Reign], 1053; repr. in *Wenyuange siku quanshu* 文淵閣四庫全書 [Wenyuan Pavilion copy of the *Complete Library of the Four Treasuries*], vol. 211 (Taipei: Taiwan shangwu yinshuguan, 1983), 1.1b.

43 For the details of the procedure (paraphrased in this paragraph), see Hu and Ruan, *Huangyou xin yue*, 1.9a–13b.

44 Ban Gu, *Hanshu*, 21.969.

Hu and Ruan then set out to transfer the new pitches to bells and chimes.[45] The procedure was hybrid in nature: on the one hand, they transcribed the mathematical results onto the instruments, and, on the other, they molded the physicality of the bells in conformity with ancient records. Ideally, the two-pronged strategy would coordinate the right quantity with the right quality. In reality, the perfect match probably never materialized. The most critical physical property of a bell was the proportional correlation between its height and diameter. The height was supposed to correlate with the pitch standard in definitive terms, at least according to ancient records.[46] In practice, however, there was not yet a precise formula for calculating this correlation. Hu and Ruan apparently relied on but one piece of mathematical evidence, that "two and half times of [the length of] the pitch pipe makes [the height of] a bell" (*yi qi lü bei ban er wei zhong* 以其律倍半而為鐘).[47] When applied to the Yellow Bell pitch, the formula should look as follows:

Height of the Bell = 9 *cun* × 2.5 = 22.5 *cun* = 2 *chi* 2 ½ *cun*

Hu and Ruan indeed cast a 22.5-*cun* tall Yellow-Bell bell, but they also built the other eleven bells at precisely the same height. The reason was practical: a case-by-case application of this formula might have generated a *yingzhong* bell (the last one in the sequence) too slight in size. Variations in pitch were eventually determined by the thickness of the bell walls. It was much more feasible for musicologists to approximate a pitch by adjusting the wall thickness.

In sum, up to the completion of the *Huangyou New Music*, the three music reforms unequivocally upheld antiquarianism and employed similar technical solutions. All of them aimed at determining the exact numerical values of the ancient pitch standards, and all reformers resorted to the millet method or

45 The following introduction is a paraphrase of Hu and Ruan, *Huangyou xin yue*, 2.1a–4a.

46 For a brief discussion of this practice, see Li, "Song dai yinyue shijian zhong de huangzhong biaozhun yingao," 101.

47 Hu and Ruan, *Huangyou xin yue*, 2.2a. This mathematical formula may be a deviant (if not erroneous) interpretation of the original statement. When Zheng Xuan wrote "doubles and halves respectively make *zhong*" (*ge zi bei ban wei zhong* 各自倍半為鐘), the word *zhong* (bell) refers to *zhong* as in *huangzhong* and *yingzhong*, rather than a bronze bell. As he further explained, *huangzhong* is nine *cun*, and *yingzhong* is half of nine, thus four and a half *cun*. Zheng's original intention was clearly to describe the numerical correlation between two pitch standards sharing the common character *zhong* in their designations. For Zheng's original remark, see *Liji zhengyi* 禮記正義 [The correct meaning of the *Classic of Rituals*], in *Shisanjing zhushu* 十三經注疏 [Commentaries and subcommentaries on the thirteen Classics], comp. Ruan Yuan 阮元 (1815; repr., vol. 2, Beijing: Zhonghua shuju, 1982), 38.8b.

some kind of existing measures derived from other contexts (astronomical and cloth measures). These central issues and coping strategies remained unchanged in all six Song music reforms.

It is also clear from these procedural accounts that antiquarianism was no empty rhetoric. Literati made elaborate efforts to transpose the antiquarian initiatives into technical plans, which constituted the framework of each reform. These literati also exercised real power, working with the emperor's personal commission and commanding the cooperation of court artisans (despite the practitioners' occasional efforts to circumvent their demands). The creation of proper ceremonial music most certainly occurred on the intellectual grounds of literati, where they theorized to weld cultural meanings onto technical procedures.

4 Cosmic Coherence

Although the translation from antiquity to quantification seemed to follow some established procedures, one ambiguity still remains: what/when exactly was antiquity? This section introduces the third proposition, that good music bore a harmonious relationship to the cosmos, and eventually demonstrates how all three propositions integrated into a coherent configuration.

If restoring an ancient pitch literally meant identifying the specific pitch used in the classical period, the practices of Song literati obviously did not fully conform to this expectation. First, the Song literati identified different parts of the classical period as antiquity. By using millet from the presumed birthplace of Shennong, He Xian seemed to locate antiquity in legendary high antiquity, yet he also enlisted a stone measure, a third-century replica of a Western Zhou standard, which evoked a later antiquity. He Xian demonstrated further inconsistency beyond this. While the Western Zhou was a sensible choice for defining antiquity (given Cai Yong's narrative on the "blind genius"), He did not further engage the specifics of this historical period. Instead, he justified the use of the stone measure with an ambivalent, ahistorical reason: "Since a gnomon measures Heaven and Earth, it can certainly provide a model for the pitch pipes."

Even more disconcertingly, each antiquarian program seemed to include some glaringly non-ancient components. Li Zhao directly used the current Song cloth measure—something clearly modern—as the new metric standard. Hu and Ruan endorsed the most contemporaneous standard measure, which

was stipulated in the *Tiansheng Code* (*Tiansheng ling* 天聖令, c. 1023–1032).[48] As ostensibly modern as these details were, Song reformers made no mention of them while criticizing each other's deviance from antiquity. For instance, when Ruan and Hu criticized Li Zhao, they faulted other details such as the new base-9 system. It is a telling sign that we should not simply view these procedures as mishaps.

Another more latent crack in the antiquarian scheme lay in the numbers themselves. This was a problem for all post-Han musicologists, including the Song literati. Nine *cun*, the immutable dimension of the Yellow Bell, was not really an invariant standard in ancient times. The number nine (and the eleven numerical values derived from it) did not assert exclusive validity until the "adding and subtracting in thirds" method became fully established, and this occurred no earlier than the Han dynasty. Various other options remained in use before and even during the Han. For instance, according to the *Master Lü's Spring and Autumn Annals* (*Lüshi chunqiu* 呂氏春秋), the legendary Yellow Emperor first used a pipe "three *cun* nine *fen*" in length to produce the Yellow Bell pitch.[49] Even the *Records of the Scribe* (*Shiji* 史記), a text composed in the Western Han, recorded a different set of data:[50]

Yellow Bell	8 *cun* 7 *fen* 1 *li*
taicu	7 *cun* 7 *fen* 2 *li*
linzhong	5 *cun* 7 *fen* 3 *li*
yingzhong	4 *cun* 3 *fen* 2 *li*

It is barely possible that Song musicologists were not aware of these historical variations, for these data sets were preserved intact in various sources. For instance, they were systematically summarized in the *History of the Sui* (*Suishu* 隋書), a standard official history.[51] They also appeared in the encyclopedia *Jade Sea* (*Yuhai* 玉海) compiled in the Southern Song (1127–1279), which indicates that this set of data was common throughout the Song.[52]

48 For the connection with the *Tiansheng Code*, see Hu Jingyin, "Cong Da'an dao Dasheng," 117.

49 Xu Weiyu 許維遹, *Lüshi chunqiu jishi* 呂氏春秋集釋 [Collected annotations on the *Spring and Autumn of Mr. Lü*] (1935; repr. Beijing: Zhongguo shudian, 1985), 5.14.

50 Sima Qian 司馬遷, *Shiji* 史記 [Records of the scribe] (91 BC; repr. Beijing: Zhonghua shuju, 1975), 25.1249.

51 Wei Zheng 魏徵 et al., comps., *Suishu* 隋書 [History of the Sui] (636; repr. Beijing: Zhonghua shuju, 1973), 16.388.

52 Wang Yinglin, *Yuhai*, 6.124.

Song literati's collective acceptance of these discrepancies strongly suggests a different understanding of antiquity, one that goes beyond the literal and historical definition characterized with temporal exactitude. Indeed, we cannot fully capture the Song conception of antiquity without taking into account its theoretical horizon: a cosmological narrative emerging contemporaneously with the harmonics system during the Han period.

As I explain in this section and the next, this cosmological narrative did not assign the ancients to be the *inventors* of the perfect, original pitch standard. Both ancients and moderns sought to disclose some pre-existing pitch standard against an eternal cosmos. This narrative placed the pitch standard at the center of the universe and identified it as the source of an all-encompassing cosmic order. Ancient sages were exemplary individuals who understood this cosmic order and translated it into material form, such as music. To pursue the original pitch standard, a Song person could repeat the empirical procedures the ancients had followed (such as reviving historical measures) in the hope of duplicating the result; or, he could find ways to connect to the timeless cosmos that transcended specific historical contexts. The second possibility caused the seemingly ambiguous definition of antiquity.

The pitch standards occupied a central position in this cosmological narrative primarily because they assumed a universal metric power, an argument established since the Han at the latest. For instance, in the *Records of the Scribe*, Sima Qian correlated the pitch standards with all earthly regulatory systems:

> The king's [endeavors in] managing affairs, instituting standards, measuring things, and erecting rules all find their origins in the six pitch standards. The six pitch standards are the roots of the myriad things.[53]
>
> 王者制事立法，物度軌則，壹稟於六律，六律為萬事根本焉。

More specifically, the pitch standards served as the prototype of all measurements. One line in the *Book of Documents* (*Shangshu* 尚書) stated this point:

> The pitch standards: measures, volumes, and weights.[54]
>
> 同律，度量衡。

53 Sima Qian, *Shiji*, 25.1239. Here the pitch-standards are six, not twelve, for only the six *lǜ* are included.

54 *Shangshu zhengyi* 尚書正義 [The correct meaning of the *Book of Documents*], in *Shisanjing zhushu*, vol. 1, 3.9a.

Kong Yingda's 孔穎達 (574–648) unpacked it as follows:

> All standards of measures, volumes, and weights have descended from pitch standards. That is why the pitch standards are called "standards."[55]
>
> 而度量衡三者，法制皆出於律，故云律，法制也。

Therefore, the compilers of most standard dynastic histories and encyclopedias grouped pitch standards together with calendars, establishing "Pitch Standards and Calendar" (*lüli* 律曆) as a taxonomical convention. Scholars who discussed pitch standards often also had expertise in calendrical studies. The arrangement evinced a clear message, that the metric authority of pitch standards was as prominent as a calendar, both regulating the entire universe rather than any specific section of it.

The central significance of pitch standards also pertained to their connection with the cosmic force, *qi* 氣. *Qi* permeated the universe as well as the human body, serving as the primal moving force of all changes as well as the fundamental texture of all things.[56] The *Records of the Scribe* characterized the connection between pitch standards and *qi* as follows:

> Pitch standards and calendars are how Heaven distributes the *qi* of the Five Processes and the Eight Directions as well as how it brings the myriad things into completion.[57]
>
> 律曆，天所以通五行八正之氣，天所以成孰萬物也。

The most telling evidence on the connection between *qi* and pitch standards resides in a practice known as "observing *qi*" (*houqi* 候氣). Scholars believed that they could observe the movements of *qi* with the aid of pitch pipes. First they paired each pitch pipe with one of the twelve major solar terms. For instance, the Yellow Bell corresponded to the winter solstice. The twelve pipes were then placed in a well-insulated chamber, each filled with reed ashes. The solar terms were supposed to witness major movements of the *qi*; for instance, on the winter solstice the *yang* type of *qi* commenced to rise. When a change like that occurred, it would presumably "activate" the ashes in the

55 *Shangshu zhengyi*, 3.11a.

56 Angus C. Graham, *Disputers of the Tao: Philosophical Argument in Ancient China* (Chicago: Open Court, 1989), 101.

57 Sima Qian, *Shiji,* 25.1243.

corresponding pipe and cause them to disperse.[58] Thus, by watching the movements of the ashes one was able to trace the fluctuations of the *qi* through the course of a year.

Having defined the universal metric power of the pitch standards, Han scholars further wove them into the fabric of the cosmic order through elaborate numerological arrangements. They imputed rich cosmological meanings to the numerical values of the pitch standards. In theory, the "adding and subtracting in thirds" method could apply to any set of numbers. In the example from the *Records of the Scribe*, the Yellow Bell was eight *cun* seven *fen* one *li*, and *linzhong*, the fifth pitch, was seven *cun* seven *fen* two *li*. Mathematically speaking, they were correlated in the same way as a nine-*cun* Yellow Bell and a six-*cun linzhong*. But Han scholars found nine particularly attractive for cosmological reasons. A nine-*cun* Yellow Bell warranted that the other two key pitches would be integers: *taicu* (the fourth pitch), eight *cun*, and *linzhong*, six *cun*.

These integers paved the way for further philosophizing. The *History of the Han* (*Hanshu* 漢書) compared the three pitch standards—Yellow Bell, *taicu*, and *linzhong*—to the "concordances" (*tong* 統) of Heaven, Earth, and Humanity. *Tong* was a rich concept which simultaneously indicated tradition, rulership, and coherence. "The three concordances are mutually connected," the *History of the Han* argued, so that "the lengths of the Yellow Bell, *linzhong*, and *taicu* are integers with no fractions" 三統相通，故黃鐘、林鐘、太簇律長皆全寸而亡餘分也.[59]

The Han discourse further tied nine, eight, and six to the *Book of Changes* (*Yijing* 易經), the numerological system based on the transmutations of trigrams. The *History of the Han* asserted: "Thus the Yellow Bell is the concordance of Heaven. The pitch pipe is nine *cun* in length. Nine is the utmost harmony as well as the origin of the myriad things" 故黃鐘為天統，律長九寸。九者，所以究機中和，為萬物元也.[60] The number nine derived its significance as the maximal and the infinite from the *Book of Changes*, where it represented the *yang qi* at its peak. The imagery of the number nine was Heaven, the authority presiding over the universe.[61] It is thus apt to connect nine to the

58 For one exemplary Han account of this method, see Cai Yong, *Yueling zhangju*, 8a–b. For other analyses (with minor technical differences), see Derk Bodde, "The Chinese Cosmic Magic Known as Watching for the Ethers," in *Essays on Chinese Civilization*, ed. Charles Le Blanc and Dorothy Borei (Princeton: Princeton University Press, 1981), 351–372.

59 Ban Gu, *Hanshu*, 21.963.

60 Ban Gu, *Hanshu*, 21.961.

61 *Zhouyi zhengyi* 周易正義 [The correct meaning of the *Changes of Zhou*], in *Shisanjing zhushu*, vol. 1, *juan* 1 (*qian* 乾).1a. For the connections between numbers, hexagrams, and cosmological imagery, see Richard Smith, *Fathoming the Cosmos and Ordering the World:*

origin of "the myriad things," which was the synecdoche of the entire phenomenal world.

> After nine, the number six was correlated with Earth:
> Thus *linzhong* is the concordance of Earth. The length of the pitch pipe is six *cun*. Six is what contains the bestowal of the *yang* [*qi*] and thrives within the Six Unions. It grants forms to the firm and the soft.[62]
>
> 故林鐘為地統，律長六寸。六者，所以含陽之施，楙之于六合之內，令剛柔有體也。

In the system of the *Book of Changes*, six represented Earth (also figuratively referred to as the "Six Unions"), the other fundamental constituent of the universe. At the same time, six was also the number of the *yin qi* in its peak strength.[63]

Finally, Heaven and Earth were complemented by Humanity, which was represented by the number eight:

> Thus *taicu* is the concordance of Humanity. The pitch standard is eight *cun* long, standing for the eight trigrams (in the *Book of Changes*). [The *Book of Changes* is] what Mixi (an ancient sage, also known as Fuxi 伏羲) employed to follow Heaven and Earth, to communicate with the numinous and the luminous, and to categorize the movements of the myriad things.[64]
>
> 故太簇為人統，律長八寸，象八卦，宓戲氏之所以順天地，通神明，類萬物之情也。

Eight was the number of trigrams whose combinations constituted all transmutations in the *Book of Changes*. The *Book of Changes* was supposed to help humans to navigate their lives amid the workings of the universe. Thus, the number eight reasonably stood for human tracks in the realm of Heaven and Earth.

The pitch standards further distributed cosmological meanings as they developed into other types of measures. The *History of the Han* delineated the

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The Yijing (*I-Ching, or Classic of Changes*) *and Its Evolution in China* (Charlottesville: University of Virginia Press, 2008), 31–56.

62 Ban Gu, *Hanshu*, 21.961.

63 *Zhouyi zhengyi*, 1 (*qian*).1a.

64 Ban Gu, *Hanshu*, 21.961.

process by which the Yellow Bell pitch standard generated measures of all kinds, or "numbers" (*shu* 數) in totality. It first introduced the basic forms and functions of numbers:

> Numbers [come in the units of] one, ten, hundred, thousand, and ten thousand. [They] are what [people employ to] calculate quantities, dispose things, [understand] and comply with the patterns of human nature and destinies. The *Book of Documents* says: "[Numbers] precede and can [thereby] calculate the courses of life."[65]
>
> 數者，一、十、百、千、萬，所以算數事物，順性命之理也。《書》曰:"先其算命。"

The development from the original pitch standard to all numbers was as follows:

> [Numbers] originate in the number of Yellow Bell. It starts as one, and then multiplies by three. Accumulating three by three, it evolves into the numbers of the Twelve Divisions (equal divisions of Heaven as a perfect circle) and culminates in 177,147. All five [units of] numbers are present therein.[66]
>
> 本起於黃鐘之數，始於一而三之，三三積之，歷十二辰之數，十有七萬七千一百四十七，而五數備矣。

The square root of the Yellow Bell, three, functioned as the basic numerical unit in the formula. After repeated self-multiplication, it eventually accrued to:

$3^{10} = 177{,}147$

This number was big enough to contain all five units: one, ten, hundred, thousand, and ten thousand, hence the argument that all numbers (or rather, all basic numerical structures) were derived from the Yellow Bell.

The cosmological weight of the Yellow Bell further grew as numbers extended into various applications in the human world, such as:

65 Ban Gu, *Hanshu*, 21.956.
66 Ban Gu, *Hanshu*, 21.956.

> Calculating calendars, generating pitches, making implements, measuring circles, gauging squares, scaling weights, leveling the ground, rectifying measures, and mending volumes.[67]
>
> 夫推曆生律制器，規圜矩方，權重衡平，準繩嘉量。

On a more abstract level, numbers serve "to explore the profound and to seek the obscure, to pursue the deep and to reach to the distant" (*tanji suoyin, goushen zhiyuan* 探賾索隱，鉤深致遠).[68] Indeed, "is there anywhere that [numbers] are not used" (*mo bu yong yan* 莫不用焉)?[69] The all-encompassing utility of quantification added an important footnote to the importance of the Yellow Bell.

Now let's return to the Song music reforms. The cosmological narrative centered on the Yellow Bell provides convincing justification for the curiously modern elements in the antiquarian initiatives. The rationale for all three reforms was a return to the original pitch standard, the nexus of a cosmic-sized quantitative coherence. The central technology was to reverse-engineer from derivatives (other measures) to the original progenitor (the Yellow Bell). Since the descendants of the Yellow Bell extensively existed in human history from the beginning to the contemporary times, it was reasonable to seek evidence from either a historical artifact (e.g., a Western Jin gnomon) or a contemporaneous object (e.g., Song cloth measure). These objects derived validity from their special connections to the cosmos. The historical status of their time periods might be a factor for discerning these connections, but it was not the fundamental part of the justification. This is precisely why He Xian used a historical artifact and yet justified with a cosmological reason: if a gnomon properly measured Heaven and Earth, it should be a good descendant of the Yellow Bell and provide reliable grounds for deducing the origin.

The cosmological narrative provides a unique framework for understanding the standard of good music, which concerned the compatibility between the pitch and the cosmos. There was one and only one original pitch standard that generated all quantifications. The validity of the pitch standard inhered in its commitment to generating and sustaining proper quantitative patterns in the cosmos; it did not have a significance independent from its relation with this cosmos. In other words, the whole framework centered on relation rather than substance.

67 Ban Gu, *Hanshu*, 21.956.
68 Ban Gu, *Hanshu*, 21.956.
69 Ban Gu, *Hanshu*, 21.956.

In their quest for the missing Yellow Bell, musicologists focused on the relationship between the pitch and the cosmos as well. The point of departure was to identify one reliable measure in use. The efficacy of the chosen object evinced a good working relationship with the rest of the world, and in this sense, it had reified part of the coherence the Yellow Bell promised and thus qualified as a legitimate descendant. The reason for endorsing the measure did not reside in their essential qualities beyond the connection with the cosmos.

Up to this point, it should be clear how the three propositions—antiquarianism, quantification, and cosmology—integrated with one another and generated an elaborate system for evaluating music. It is worth noticing that the human ear was strangely absent from the scheme. In other words, sonic judgment was not an official standard of good music.

Rigorously speaking, the human ear was present as an instrument and yet absent as a standard. Song scholars acknowledged the immediacy and utility of the auditory faculty. In all three reforms they relied on hearing to identify signs of good music and symptoms of inappropriate music. Emperor Taizu decided by ear that ceremonial music was unpleasantly high-pitched and called for a reform. When Li Zhao introduced his new pitch standards, the performers knew by hearing that the new music was impossible to sing. According to some audiences, the chimes Hu Yuan made were "accurate and intricate in form" but "too high in pitch" (*xingzhi jingmi er sheng tai gao* 形制精密而聲太高).[70] The bells made by Wang Pu produced "sounds which were fast and limited-ranging" (*sheng ji er duan wen* 聲疾而短聞), while those by Hu Yuan were "leisurely and far-reaching" (*sheng shu er yuan wen* 聲舒而遠聞).[71] Hu Yuan made structural alterations to a bell of unknown but presumably older provenance, and the sounds emitted by the remodeled product were "depressed and not elevating" (*yu er bu yang* 鬱而不揚), thus "not harmonious" (*bu he* 不和).[72]

While embracing the instrumentality of the auditory judgment, Song scholars did not officially endorse it as an epistemic guide. In theory, as a musicologist worked his way through the cosmological narrative to retrieve the lost pitch standard, he was able to confirm the validity of the result before hearing it. In all three cases, hearing served to detect signs and symptoms *post eventum*, thus projecting some regulatory power; the new round of numerological calculations, however, did *not* include sonic qualities as determinants. As such, the human ear remained a contingent source of knowledge, not a constant epistemic guide.

70 Tuotuo, *Songshi*, 81.2985
71 Tuotuo, *Songshi*, 81.2985
72 Ouyang Xiu, *Guitian lu*, 1.17.

A deeper reason for neglecting the human ear lies in the different epistemological stance it represented. Relying on sensory perception as the primary source of knowledge is a classical empirical position, which would be immediately at odds with the cosmic coherence scheme. The human ear directed attention to the essential qualities of a sound rather than its connection with the cosmos. Facing the impossible task of coordinating two disparate epistemological stances, the Song scholars chose to subordinate the human ear to the cosmos.

5 Two Tales of the Genesis of the Pitch-Standards

Let us now delve deeper into intellectual history to further probe the rationale for the choice of the cosmos over the ear and how the cosmological scheme became entrenched over time. From the Han through Song, two different narratives of the origin of the pitch standards evolved, one centering on the human ear and the other, the cosmos. In the following I demonstrate how the latter eventually eclipsed the former.

We have already encountered the first narrative, which was proposed by Cai Yong and discussed in Section 2. This tale ascribed the origin of pitch standards to Western Zhou musicians' efforts at hearing and quantification. According to Cai, "the blind geniuses" in the Western Zhou, with their exceptional listening skills, were able to capture all correct pitches by ear. They then reproduced the sounds with tubal instruments of certain lengths and rendered them into numerical values. The beginning of the pitch standard system was the product of human endeavor.

The second narrative had a longer history of evolution and enjoyed much more discursive currency in the Song. The tale construed the genesis of the pitch standards as one stage of a multi-phase course of cosmic generation. The pitch standards came into existence prior to the birth of the phenomenal world. After the world came into full materialization, a sage—the Yellow Emperor—disclosed the pitch standards to humans. The emergence of the pitch standards thus had little to do with mundane human intervention.

This narrative found its roots in the post–Western Zhou era. Late Warring States 戰國 (475–221 BCE) musicologists imagined that the Yellow Emperor discovered the Yellow Bell pitch by blowing a bamboo pipe of special qualities. As they explained:

> In the past, the Yellow Emperor commissioned Linglun to determine the pitch standards. From the valley called Xiexi, which was located west of

> the Great Xia and north of Ruanyu Mountain, Linglun procured some bamboo. He chose those with hollowed stems and thick rind, and cut off a section—three *cun* nine *fen* in length—between two nodes. [He] blew the tube and produced [a sound] to be the Yellow Bell *gong* note… He then made twelve tubes, listened to the warble of the *feng* and *huang* birds under Ruanyu Mountain, and distinguished the twelve pitch standards.[73]
>
> 昔黃帝令伶倫作律，伶倫自大夏之西，乃之阮隃之陰，取竹于嶰谿之谷，以生空竅厚鈞者，斷两節間，其長三寸九分而吹之，以为黃鐘之宫。…… 次制十二筒，以之阮隃之下，听鳳皇之鳴，以别十二律。

This account is also seen with minor differences in the *History of the Han*.[74]

A common emphasis emerges as central in these similar accounts: all twelve pitch standards were discovered, not created; therefore, they must have had a previous existence which required revelation. Also, all discoveries happened under very specific conditions, including the presence of a sage, bamboo of supreme quality, and the rare appearance of the *feng* and *huang* birds. Many of these details bore a suprahuman aura.

Over time this "historical" narrative evolved without losing focus on the suprahuman nature of the pitch standards. When it appeared in the *History of the Sui*, the tale featured the same beginning:

> The Yellow Emperor commissioned Linglun to harvest some bamboo in the Xiegu valley and to listen to the *feng* and *huang* birds under the pagoda. Thereby [Linglun] made the twelve pitch standards.[75]
>
> 黃帝遣伶倫氏取竹於嶰谷，聽鳳阿閣之下，始造十二律。

In a slightly earlier version, the author of the *History of the Wei* (*Weishu* 魏書) phrased the opening of the tale as follows:

73 Xu Weiyu, *Lüshi chunqiu jishi*, 5.14–16.

74 Ban Gu, *Hanshu*, 21.961.

75 Wei Zheng, *Suishu*, 16.395. This narrative was written by Mao Shuang 毛爽 (c. sixth century).

> In the past, the Yellow Emperor obtained bamboo north of the Kunlun Mountain and listened to the *huang* bird south of the Qi Mountain. [He] cropped the natural object and transcribed the self-disclosing sounds.[76]
>
> 昔黃帝採竹昆侖之陰，聽鳳岐陽之下，斷自然之物，寫自然之音。

The term *ziran* 自然 (lit. "self-so") appeared twice, which I translate differently. I render it as "natural" as a description of the material of the instrument (the bamboo), and "self-disclosing" as a characterization of the resultant sounds. The emphasis on the lack of human artifice was clear: although an active agent (Linglun or the Yellow Emperor) was involved, he participated in—rather than directed—the process. In the first quotation Linglun was said to have "made" the pitch standards; the better contextualized meaning of his action, however, was to have transcribed a range of self-disclosing sounds emitted by a bamboo pipe and the numinous bird. Linglun was a transmitter, not an innovator. He elicited the pitch standards from a larger being presumably "self-disclosing" in character.

In the *History of the Sui*, the narrative further evolved to describe how the newly discovered pitch standards provoked movements of *qi* and generated numbers. This precisely alluded to the Han scheme I discussed in Section 4:

> [The twelve pitch standards] resonated with the *qi* of Heaven and Earth, hence the beginning of numbers. The *yang* pipes are called *lǜ*, and the *yin* pipes are called *lǚ*. The *qi* can [be observed to] watch the four seasons, and the numbers to chart the myriad things. The Yellow Emperor determined the numerical values. This is the origin of the pitch standards.[77]
>
> 乃致天地氣應，是則數之始也。陽管為律，陰管為呂。其氣以候四時，其數以紀萬物。隸首作數，蓋律之本也。

The term *shu* (數) appeared twice in this quotation and bore different meanings. The movements of the *qi* gave rise to the first *shu*, numbers in general and in totality. And the sage lent his hand to the specification of the second *shu*, the numerical values of the pitch standards themselves.

After that, humans proceeded to apply the pitches in different ways:

76 Wei Shou 魏收, *Weishu* 魏書 [History of the Wei], (554; repr. Beijing: Zhonghua shuju, 1974), 107.2657.

77 Wei Zheng, *Suishu*, 16.395.

> Thus, Yu used the pitch standards to render music harmonious, and Zou Yan modified them to establish [the system of] the Five [Powers from] Beginning [to End].[78]
>
> 故有虞用律和聲，鄒衍改之以定五始。

Zou Yan 鄒衍 (c. 305–240 BCE) was the alleged founding father of the *Yin-Yang* school. He synthesized the *Yin-Yang* and Five Processes (*wuxing* 五行) theory, which later became the foundation of Chinese cosmology. The "Five Powers" referred to the application of this theory in the political realm. By this point, a complete timeline of the development of the pitch standards had emerged:

> Discovery of the pitch standards → activation of the *qi* → emergence of numbers → concrete applications

Song scholars embraced this chronology with enthusiasm. They endorsed every critical element in the tale, and, in addition, addressed an important unanswered question: if the pitch standards were discovered rather than created, whence did they come? The Song tale, which appeared in the *History of the Song* (*Songshi* 宋史), explained the provenance of the pitch standards:

> The *dao* and its embodiment are one, which constitutes the origin of Heaven and Earth as well as the progenitor of the myriad things. When dispersed [the *dao*] becomes the *qi*, some *yin* and some *yang*. When activated [the *dao*] becomes numbers, some odd and some even. When solidified [the *dao*] becomes forms, some adamantine and some soft. When manifested as objects, some are known as *lǜ* and some are known as *lǚ*. As for ritual and music, legal institutions, weights, and volumes, all of them have descended from this (the *lǜlǚ*, pitch standards).[79]
>
> 道體為一，天地之元，萬物之祖也。散而為氣，則有陰有陽；動而為數，則有奇有偶；凝而為形，則有剛有柔；發而為聲，則有清有濁，其著見而為器，則有律、有吕。凡禮樂、刑法、權衡、度量皆出于是。

In short:

78 Wei Zheng, *Suishu*, 16.395.
79 Tuotuo, *Songshi*, 24.1603.

dao	→	*qi*	→	numbers	→	forms	→	objects
		(dispersed)		(activated)		(solidified)		(manifested)

The pitch standards were a kind of primal object which further generated quotidian objects, such as measurements and institutions.

By transplanting the pitch standards into this even grander scheme, the Song scholars found an elaborate way to frame the pitch-standards' ascendancy. First, they were the descendants of the primordial coherence of the cosmos, the *dao*. By way of the intermediary stages of cosmic development ("numbers" and "forms"), the pitch-standards emerged at the transition from the numinous to the phenomenal world. "Objects" signified the beginning of the phenomenal world, whereas the first four stages—the *dao*, the *qi*, numbers, and forms—occurred prior to the emergence of humans.[80] "Numbers" represented a stage in which the structures of the cosmos became intelligible in the form of numerical ratios. Some primal numbers I discussed in Section 4, such as six, eight, and nine, are examples of these structures.[81] After procuring numerical structures from "numbers," the pitch standards attained some kind of physical shape from "forms." They eventually became "objects" as all constituents were in place. It is clear that humans had no influence over this process because they emerged later.

As the cosmological tale grew more sophisticated, musicologists responded with more creative ways to interpret cosmic coherence in praxis. Let me conclude this section with the sixth Song reform, the most curious of all, which would make sense only in the consummation of the second tale. The last reform occurred during Emperor Huizong's reign in 1104. Despite the monarch's pronouncement of a true restoration of ancient music, the reform has remained a subject of derision in history. The new system discarded most of the solemn mathematical endeavors and, surprisingly, adopted the emperor's middle finger as the new measure.

The philosophy behind the project, however, was a perfect continuation of the cosmic scheme, except for a twist that was perhaps too creative. The musicologist in charge of this initiative, Wei Hanjin 魏漢津 (c. 1017–1106), seized another historical reference to steer his reform in the peculiar direction.[82] In a

80 Kidder Smith, Jr. and Don Wyatt, "Shao Yung and Number," in *Sung Dynasty Uses of the I Ching,* ed. Smith, Peter K. Bol, Joseph A. Adler, and Wyatt (Princeton: Princeton University Press, 1990), 105–112.

81 For the more elaborate applications of number, see Smith and Wyatt, "Shao Yung and Number," 113–127.

82 Joseph S. C. Lam examines in detail the process of this reform. See Lam, "Huizong's Dashengyue," 395–452. For more contextualization of this event, see Patricia Buckley

less known ancient source, "Wu di de" 五帝德 (Virtues of the Five Sage Emperors), the sage Yu was said to set "[his own] voice" (*sheng* 聲) as the pitch standard and "[his own] body" (*shen* 身) as the measure.[83] More specifically, the sage used his finger to determine the dimension of one *cun*, and his arm to measure one *chi*.[84] In this version of the genesis tale, the sage replaced the bamboo tube and bird cries with his own body as cues to discover the hidden truth. If the sages were exemplary humans with an exclusive understanding of cosmic coherence, it would not take a large leap of faith to assume that they were another kind of numinous being (like superior bamboo and *feng* and *huang* birds) and that their physical features bore connections to fundamental cosmic structures.

The idea to use Emperor Huizong's measurements took one more simple step of induction. Since an ancient sage's physicality served as the key to disclosing cosmic coherence, a contemporary sage should merit the same status. As obsequious as it sounded, it was a perfect line of political argument to call the reigning emperor a sage.[85] Therefore, Huizong claimed his contemporary sagehood, letting his finger become the new natural and numinous object which disclosed the secrets of pitch standards. The timeless cosmic coherence shone again, this time through the living body of an aspirant monarch.

6 Conclusion

In the Song, a harmonious melody not only pleased one's ear, but also signified order and authority. Music's ideological heft motivated Song literati to participate in this seemingly technical art and built an elaborate discourse on it. They specifically relied on three propositions as standards for evaluating the quality of music. First, one should model modern music after ancient music. Second, the key to retrieving old music was to determine the original pitch standard with an arithmetic approach. Third, the lost pitch standard was the nexus of a coherent and timeless cosmos, and its primary function was to generate

Ebrey, *Emperor Huizong* (Cambridge, MA: Harvard University Press, 2014), 160–165.

83 Wang Pinzhen 王聘珍, *Da Dai Liji jiegu* 大戴禮記解詁 [Explications of the *Records of Rituals by Dai Senior*] (1851; repr. Beijing: Zhonghua shuju, 1983), 7.124.

84 Wang Pinzhen, *Da Dai Liji jiegu*, 1.4.

85 For Huizong's claim on sagehood through reinvigorating ritual and music, see Ari Daniel Levine, "The Reigns of Hui-tsung (1100–1126) and Ch'in-tsung (1126–1127) and the Fall of the Northern Sung," in *The Cambridge History of China, Vol. 5, Part One: The Sung Dynasty and Its Precursors*, 907–1279, ed. Denis Twichett and Paul Jakov Smith (Cambridge: Cambridge University Press, 2009), 606–614; and Peter K. Bol, "Emperors Can Claim Antiquity Too: Emperorship and Autocracy Under the New Policies," in Ebrey and Bickford, *Emperor Huizong and Late Northern Song China*, 191–200.

concrete measures throughout the world. Taken together, one should aim to restore ancient music, which was the best possible human product made in accord with the perfect, cosmic pitch. He could look to historical practices for precedents, or reverse-engineer a contemporary measure back to its putative origin. The three-part scheme defined good music in terms of its relation with the ever-expanding cosmos. In other words, cosmic coherence presented the ultimate standard of validity for music. The human ear, an evaluative faculty of the essential qualities of sounds, was relegated to the status of a contingent reference. Therefore, good music might arise from a bronze gnomon, a cloth measure, or a finger of the emperor, but not from an acute ear. The Song musicologist kept his ear to the cosmos, where he sensed the stars adrift, the winds whistling, and the entire coherent being breathing and pulsating in eternity.

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